Wyoming's Coal Resource

Summary Report
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Introduction

Back in the 1860s, when Wyoming coal was used as a fuel for railroad construction and new locomotives – to its highly evolved production process today, the state's coal resource has long made its mark in history. Wyoming coal will likely continue to be recognized as an important energy source because it is a low-cost, low-sulfur mineral. Combine this with the plethora of reserves remaining in the ground and Wyoming's coal resource will likely continue to help feed the nation's appetite for reliable energy for many years to come.

Wyoming remains as the top coal-producing state in the United States. In 2012, more than 401 million tons were produced from 18 coal mines in the state. Wyoming's 11 coal companies produced as much coal as the next top six coal-mining states combined (West Virginia, Kentucky, Pennsylvania, Illinois, Texas, and Montana).

Wyoming's most prolific coal region, the Powder River Basin (PRB) in Campbell and Converse counties, has one of the greatest supplies of coal in the world (see table). Nine of the nation's 10 largest coal mines operate as surface mines in the PRB. Wyoming also has surface mines near Rock Springs and Kemmerer, and one underground mine, the Bridger Mine, in Sweetwater County.

Wyoming is home to some of the most efficient coal mines in the nation. The shallow coal produced is less expensive to mine and burns cleaner than high-sulfur coal from other parts of the country. In the PRB, the thick coals in the Tongue River Member of the Fort Union Formation are considered high quality "clean coal" for power plants.

The U.S. Energy Information Administration predicts a positive future for PRB coal. While many utilities have been turning to natural gas for new generating capacity, an increase in natural gas prices in 2013 resulted in a greater use of coal than expected for electrical generation.

Estimates for 2013 indicate that Wyoming coal production fell by 3.3% since 2012, from 401 million tons to 388 million tons. However, the average spot price of Powder River Basin coal increased by 6.7%, from $9.91 per ton in 2012, to more than $10.58 per ton in 2013.

The recent coal production decline has been fueled by more stringent air quality standards and low natural gas prices that have resulted in many utilities switching from coal to natural gas-fired power plants.

Wyoming coal production by county and mining method, 2012. *Wyoming State Inspector of Mines, 2013.*

(units in short tons)	2012	Method	
County	Production	Under-ground	Surface
Campbell	354,060,413		354,060,413
Carbon	786		786
Converse	34,316,314		34,316,314
Hot Springs	24,040		24,040
Lincoln	4,659,485		4,659,485
Sweetwater	8,396,036	4,636,557	3,759,479

Coal Production

Wyoming produced 401,457,074 tons of coal in 2012. This represents 39 percent of the entire nation's coal production. Most of this coal is burned in power plants to make steam for generating electricity, but about 1 percent is used for industrial purposes. The largest U.S. coal mine is Peabody Energy North Antelope Rochelle Complex in the Powder River Basin (PRB). It produced more than 107 million tons of coal in 2012. The nation's second largest coal mine, Arch Coal's Black Thunder Mine also in the PRB, produced more than 93 million tons in 2012. Together these two Wyoming mines produce more than 20 percent of the entire nation's coal.

Coal Distribution and Consumption

The Powder River Basin is the largest producer of coal in the state. A portion of this coal is used for electricity generation for Wyoming power plants, but the majority is exported to power plants in 33 other states. More than 94 percent of Wyoming coal is transported by railway. The Wyoming Mining Association estimates 75 to 80 trains (13,000-tons for each one) of coal are exported each day to markets.

In 2012, the five states that imported the most Wyoming coal included (in order): Texas (57 million tons (MT)), Illinois (53 MT), Iowa (25 MT), Kansas (18 MT), and Wisconsin (18 MT). In-state, Wyoming's power plants consume about 28 million tons of coal annually, which is about 6 percent of the state's total production. Wyoming industries also import a small amount (52,000 tons annually) from Montana and Pennsylvania, with 399 MT used for domestic distribution, and 3.1 MT for foreign export.

In May 2013, Wyoming produced its 10 billionth ton of coal over the 150-year history of coal mining in the state. The North Antelope/Rochelle Mine produced approximately 111 million tons of coal in 2013, or 11% of the entire nation's coal.

Value of Wyoming Coal

As a commodity resource, the price of coal is a major consideration in the decision to mine or not. In 2012, the average spot price for Powder River Basin coal was $9.69 per ton. This was a considerable drop from the $13.61 per ton average spot price in 2011.

Nationally, in 2011-2012 low natural gas prices led to increased fuel-switching at some power plants, which depressed the market for coal. Gas prices increased by the latter half of 2012 and coal-fired electricity was once again on the upswing (University of Wyoming, Department of Agricultural and Applied Economics).

For the 401 million tons produced in 2012, the total estimated value of all coal produced in the state was approximately $4 billion. The mineral tax revenue of Wyoming coal to state and local government was approximately $1 billion in 2012. Wyoming's coal industry provides approximately 6,900 jobs annually, accounting for more than 25 percent of Wyoming's total mining sector employment, according to the U.S. Bureau of Labor and Statistics (2013).

Resources and Reserves

The U.S. Geological Survey, in the agency's most recent study of coal reserves in the Powder River Basin, estimates 127 billion tons of recoverable coal remain in the Wyoming portion of the basin (2010). Since 1994, more than 7 billion tons of coal has been mined in Wyoming. There are 6.9 billion tons of coal reserves currently under lease at active Wyoming coal mines, a figure that represents about 37 percent of the nation's current "mineable" coal supply.

Coal Geology and Quality

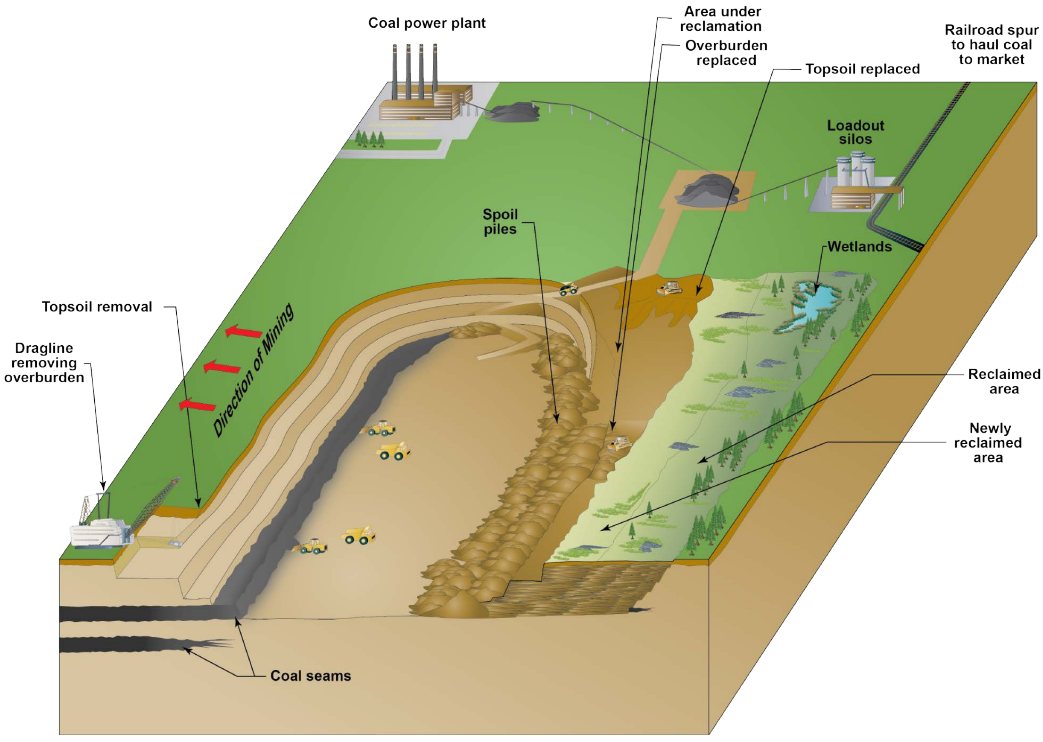
Wyoming coal ranges from Upper Cretaceous (144 to 65 million years ago) to Eocene (56 to 34 million years ago) in age. Bituminous and subbituminous coals have been mined from the Upper Cretaceous Mesaverde Group and Almond Formation in the past, but current mining primarily occurs in the Paleocene Fort Union Formation as well as the Upper Cretaceous Adaville, Lance, and Almond formations.

Wyoming has the world's largest deposits of low-sulfur sub-bitumious coal. It does not require the cleaning and processing as with much of the coal in the eastern United States. This means Wyoming coal companies can ship the coal they mine directly to power plants. Low-sulfur Wyoming coal is often blended with high-sulfur eastern U.S. coal at power plants to form an environmentally compliant fuel source.

Reclamation

Wyoming's surface reclamation program is the largest in the U.S. Reclamation is an important process with coal mining especially when it comes to large surface mining operations such as those in the state.

These large excavations of earth must be reclaimed to the



Coal mining in Wyoming primarily occurs in surface mines. Coal seams relatively close to the surface, at depths less than approximately 180 ft, are usually surface mined. Mining at this scale involves draglines, trucks, and conveyors. Other activities at the mine include reclaiming the land once mining in an area has been completed. *Graphic by James R. Rodgers.*

original contour and grade, and re-vegetated when mining has been completed. The Land Quality Division of the Wyoming Department of Environmental Quality, in conjunction with the U.S. Office of Surface Mining provides oversight, enforcement, and administration of state and federal statutes regarding coal mining and regulations in Wyoming.

Future of Coal Mining

The future of Wyoming's coal industry is in flux. With industry continuing to implement technological advances, increases in efficiency of production appears certain. While such advances are important to industry and the state, it comes at a time when U.S. Environmental Protection Act (EPA) regulations are scheduled to take effect in 2014 that will limit $C0_2$ emissions from new coal-fired power plans to 1,100 pounds per megawatt-hour (gross over a 12-month period) of energy produced. Gas-fired electrical power generation, with half the $C0_2$ emissions of coal, may play a larger role in the future. But the future of coal does not have to appear totally bleak. New technologies and products from coal may increase its value and create new opportunities for Wyoming's economy.

In the meantime, the Energy Information Administration projects that U.S. coal production will grow by 3.6 percent in 2014. Higher natural gas prices, due to increased use for electrical generation, will offset short-term electricity needs by that industry in favor of coal-fired power. However, a longer-term projection to 2015 forecasts a further reduction in coal-fired power plants as older plants retire and new plants face the new stringent regulations under the EPA's Mercury and Air Toxics Standards and new source reviews.

Fortunately for Wyoming the state naturally has some of the lowest sulfur, mercury, and arsenic concentrations in coal in the U.S. Coal-fired power plants have historically been the main source of electricity because of their safety, inexpensive operational costs, and reliability to keep the lights on as a base-load electric fuel; yet coal-fired power decreased in use in 2011-2012 by 12 percent nationally. While the majority of coal mined in Wyoming today comes from the Powder River Basin (PRB) the Wyoming State Geological Survey is conducting research on other basins with coal to determine their economic viability.

In the future, Wyoming also hopes to export its coal to growing international markets such as those in Asia. These countries are creating global competition for coal as their economies expand. Most of Asia relies on coal to fuel their electricity needs. For example, China produces more than 50 percent of its electricity from coal, and Japan must replace its current nuclear power needs with other sources such as coal.

The PRB coal can meet this increased demand as Korean and Japanese companies now import about 5 million tons of PRB coal annually through Vancouver, BC Canada. Due to its clean nature, PRB coal is expected to grow beyond the export volume of those ports, thus supporting efforts to open new U.S. ports in the northwest for Wyoming coal exports.

Other Sources

Wyoming Department of Environmental Quality
Wyoming State Inspector of Mines
Mineral Information Institute
U.S. Department of Labor, Mine Safety and Health Administration

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For updated information, scan this QR code to access the WSGS coal website.

www.wsgs.uwyo.edu

WYOMING STATE GEOLOGICAL SURVEY
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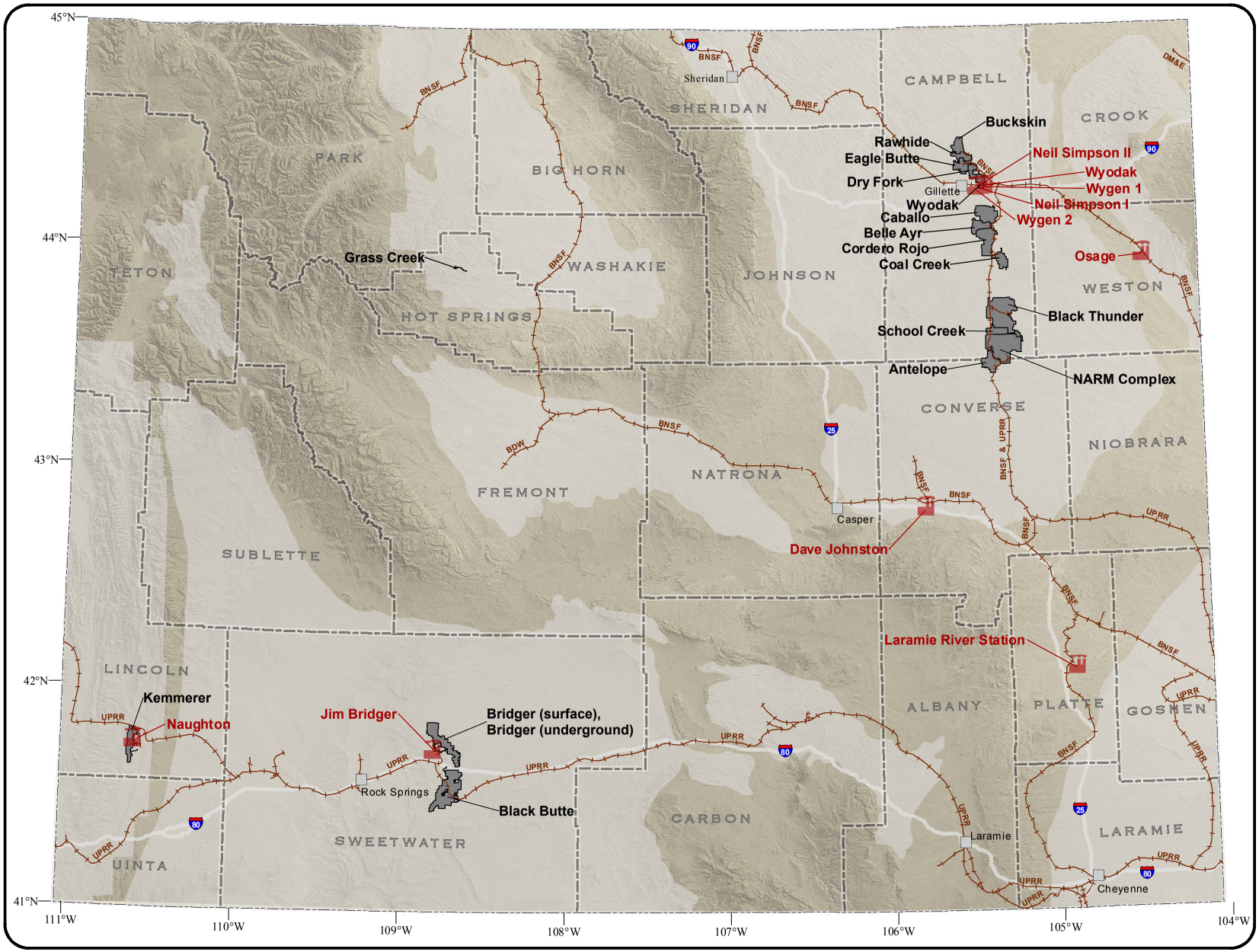
Geology - Interpreting the past - Providing for the future



EXPLANATION

Active coal permit boundary (2013)

Coal regions

Power plants (coal)

City or town

Interstate highway

County boundary

Railroads

UPRR – Union Pacific Railroad

BNSF – Burlington Northern Santa Fe Railway

N

0 10 20 40 Miles

0 15 30 60 Kilometers

Map design and layout by Phyllis Ranz 2/2014

Wyoming Coal